SINGAPORE UNIVERSITY OF TECHNOLOGY AND DESIGN

24 July – 17 September 2021

TOPICAL REPORT

ROBOTICS & AUTOMATION

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news

AUTOMATION

Automation in manufacturing: What you need to know

"Manufacturing automation refers to the use of technologies such as equipment and software to automate production processes. Whereas it may seem like a novel concept, that's not an accurate assessment. There's evidence of simple attempts to automate tasks throughout history. The manufacturing process is highly diverse. As such, there are different types of manufacturing automation to cater to different aspects."

Source: Robotics & Automation

Several ways on how robotic technology can optimize efficiency in manufacturing

"In factories, advanced technology use has generated novel opportunities for businesses and startups to study additional possibilities of addressing constantly changing and unique expectations. Robotic devices implemented in manufacturing execute a wide range of functions. In manufacturing, entirely autonomous robotic equipment is traditionally required for repetitive, high-scale practices where the rapidity, durability, and accuracy of a robot enable unparalleled pluses."

Source: Robotics & Automation

academic

AUTOMATION

Rapid metrology of precision-machined parts via robotic automation

"Precision-machined parts in aviation, automotive, and manufacturing industries have tightly controlled tolerances for the dozens of small geometries spread throughout a single part. These parts can also have stringent specifications for any defects along the surface. The sheer number of measurements needed on each part paired with the volume of parts demands the ability to take not only one measurement quickly, but dozens in a rapid process. Coupling a polarized structured light technique with robotic automation allows for accurate measurements at volume. This paper will discuss automated optical measurements of stationary parts, parts moving on a production line, and rotationally symmetric parts on a rotary stage. The paper will also look at ongoing projects combining the automated polarized structured light method with bright field techniques to accomplish automatic defect identification and inspection."

Source: SPIE

Creating Value with Open Smart Home Automation Systems

"This article discusses the advantages and potentials products of ABB, a

reports

AUTONOMOUS VEHICLES

Autonomous Cars, Robotaxis & Sensors 2022-2042

"In recent years, vast improvements to autonomous vehicle technologies such as radar, lidar, HD cameras and software have propelled robotaxis to the cusp of market-readiness. Autonomous trials from Waymo, Cruise, and others are now evolving into autonomous services, with legislative barriers clearing. New IDTechEx forecasts reveal how these services will come to dominate within 20 years, creating massive opportunities for the underlying sensors market, which grows at over 30% CAGR."

Source: ID Tech Ex

ROBOTICS INDUSTRY

New Research Analyzes Investor Reaction to Robo-advisors, Some People are Missing an Opportunity

"Research Study Key Takeaways:
Investors who factually need the help from robo-advisors (RAs) are less likely to try RAs.
Investors adjust their use of RAs based on recent RA performance: When RA

Current Trends in Automated Manufacturing Lines

"A lot has been debated on how the fourth industrial revolution will provide manufacturers with vast opportunities to use advanced tools throughout the manufacturing cycle.

While there isn't a doubt that the fourth industrial revolution has enhanced operational efficacy, it's time to turn towards industry 5.0 – a preliminary facet of the sixth revolution."

Source: Robotics & Automation

Study: As a population gets older, automation accelerates

"The study finds that when it comes to the adoption of robots, aging alone accounts for 35 percent of the variation among countries. Within the U.S., the research shows the same pattern: Metro areas where the population is getting older at a faster rate are the places where industry invests more in robots."

Source: MIT

AUTONOMOUS VEHICLES

Driving will be outlawed for humans by 2050, says IDTechEx

"Technology has always caused changes to the laws on how we operate vehicles; as vehicles became faster, speed limits were introduced. When mobile phones emerged their use in vehicles had to be outlawed; as autonomous drivers outperform humans will we be banned from driving altogether? The IDTechEx report covers safety and regulation, a key barrier for adoption. One trend identified is with vehicle safety certifiers mandating higher levels of automated safety, and the inclusion of sensors such as radar."

Source: Robotics & Automation

Autonomous vehicles ranked among top 10 innovations attracting investment

"The convergence of automotive and technology industries is accelerating the pace of innovation in the mobility and transportation sectors, leading to a surge in patent grants relevant to autonomous vehicles while also attracting venture capital investors' interest in the area."

Source: Robotics & Automation

global leader in electrical products and solutions, offer. The company's smart home automation system ABB-free@home® provides sufficient solutions for an automated home, such as a detection grid, which notices the owners approaching their house on the basis of hardware supply. However, the article identifies shortcomings regarding the software. The company may overhaul its direct connection to the consumer as opposed to its current third-party outsourcing. The implementation of cloud-based solutions and a reduced dependence on hardware could greatly improve the services and products provided by ABB."

Source: Springer Link

Load Control: A new era of intelligent automation

"Imagine that we traveled into the future where more than 50% of electricity production is generated by wind and solar. Will you wonder how the grid will operate in an overcast, windless, extremely cold/hot day, where half of its generation fleet may become unavailable?"

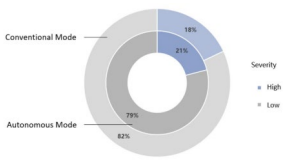
Source: IEEE Xplore

Digital Technologies and Automation: The Human and Eco-Centered Foundations for the Factory of the Future [TC Spotlight]

"Reports on the factory of the future where automation dominates operations. Digital manufacturing processes have been extensively transformed by ubiquitous connectivity and collaborative robots so much that the industry of the future is pursuing high productivity, efficiency, and customization by becoming increasingly collaborative, connected, and cognitive (IC3). In fact, these new technologies have fostered a remarkable increase in production efficiency and an exceptional economic growth worldwide."

Source: IEEE Xplore

AUTONOMOUS VEHICLES



Divergent Effects of Factors on Crashes under Autonomous and Conventional Driving Modes Using A Hierarchical Bayesian Approach

"Influencing factors on crashes involved with autonomous vehicles (AVs) have been paid increasing attention. However, there is a lack of

performance is low, investors immediately decrease their usage, and vice versa.

Quick changes in RA usage often leads to worse investment performance, especially when the adjustments are frequent and substantial."

Source: INFORMS

Mobile Robots Revolutionize Industry (IFR releases paper "A Mobile Revolution")

"Robot mobility is booming worldwide: Unit sales of Autonomous Mobile Robots (AMRs) in the logistics sector e.g. will increase by 31% between 2020 and 2023 annually. At the same time, the use of AMRs in public environments will also go up rapidly – IFR predicts unit sales will grow by 40% per year worldwide."

Source: International Federation of Robotics

Growth Opportunities In Cobots, Autonomous Mobile Robots, 3d Printing, And Industrial Automation

"The Advanced Manufacturing Technology Opportunity Engine for September 2021 covers innovations related to additive manufacturing, collaborative robots, autonomous mobile robots, and industrial automation. Some of the innovations profiled include 3D printing of large metal parts, microscale glass printing, multi-material 3D printing for the textile industry, autonomous mobile robots with extended payload, and collaborative robots.

The Advanced Manufacturing TOE covers global innovations and developments related to manufacturing and industrial automation on a monthly basis. Innovations are focused toward improving product traceability, energy efficiency and reducing environmental footprints, integrating product design and manufacturing aspects for reducing time-to-market. Research focus areas include rapid prototyping (additive manufacturing), lightweighting (multimaterial joining, plastics and metals manufacturing, carbon fiber-based composite manufacturing), smart robotics (agile robots, consumer robots, swarm robotics, cobots), monitoring and control (wireless control networks, human machine interface), and simulation and modeling (design and simulation software)."

Source: Frost & Sullivan

Emerging Opportunities for Robotic Arms in Manufacturing

"A robotic arm is a programmable mechanical arm that consists of actuators placed at the joints to

Study: Benefits Outweigh Risks for Autonomous Vehicles – As Long As You Regulate Them

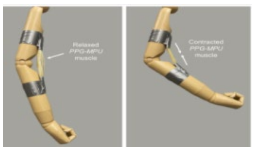
"An interdisciplinary panel of experts has assessed the risks and potential benefits associated with deploying autonomous vehicles (AVs) on U.S. roads and predicts that the benefits will substantially outweigh potential harms – but only if the AVs are well regulated. "We wanted to assess the potential harms and benefits associated with AVs and determine what the best implementation strategies would be to minimize harms and maximize benefits," says Veljko Dubljević, first author of the study and an associate professor in the Science, Technology & Society (STS) program at North Carolina State University."
Source: NC State University

ROBOTICS INDUSTRY

The mobile revolution

"Robots are on the move! Autonomous mobile robots are changing how work is done in a number of industry sectors, with health and other benefits for companies and employees.
For decades, robots have been largely stationary. Now, however, robots are able to move around autonomously, navigating according to an internal map which can be updated in real-time. These Autonomous Mobile Robots (AMRs) can respond to unexpected objects in their path, either slowing, or stopping as appropriate. They can replan their route in response to obstacles, generally with the help of fleet management systems that coordinate and monitor the activity of multiple AMRs."
Source: International Federation of Robotics

SOFT ROBOTICS



High-energy shape memory polymer could someday help robots flex their muscles

"When stretched or deformed, shape memory polymers return to their original shapes after heat or light is applied. These materials show great promise for soft robotics, smart biomedical devices and deployable space structures, but until now they haven't been able to store enough comparative analyses between influencing factors on crashes of AVs and human-driven vehicles. To fill this research gap, the study aims to explore the divergent effects of factors on crashes under autonomous and conventional driving modes. This study obtained 154 publicly available autonomous vehicle crash data (70 for the autonomous driving mode and 84 for the conventional driving mode), and 36 explanatory variables were extracted from three categories, including environment, roads, and vehicles. Then, a hierarchical Bayesian approach was applied to analyze the impacting factors on crash type and severity under both driving modes. The results showed that some factors affected both driving modes, but their degrees were different."
Source: Cornell University

Toward a hybrid causal framework for autonomous vehicle safety analysis

"In this article, we analyze the literature to first build an argument that a new safety framework is needed for AVs. We then use the identified limitations of current methodologies as a basis to formulate a set of fundamental requirements that must be met by any proposed AV safety framework. We propose a new AV safety framework based on the Hybrid Causal Logic (HCL) methodology, which combines Event Sequence Diagrams (ESDs), Fault Tree Analysis (FTA), and Bayesian Networks (BNs). The HCL framework is developed at a conceptual level and then evaluated versus the identified fundamental requirements. To further illustrate how the framework may meet the requirements, a simple example of an AV perception system scenario is developed using the HCL framework and evaluated. The results demonstrate that the HCL framework provides an integrated approach that has the potential to satisfy more completely the fundamental requirements than the current methodologies."
Source: Sage Journals

Segment Drift Control with a Supervision Mechanism for Autonomous Vehicles

"Stable maneuverability is extremely important for the overall safety and robustness of autonomous vehicles under extreme conditions, and automated drift is able to ensure the widest possible range of maneuverability. However, due to the strong nonlinearity and fast vehicle dynamics occurring during the drift process, drift control is challenging. In view of the drift parking scenario, this paper proposes a segmented drift enable different functions and handle varying payloads, similar to how the human arm works. Some common activities performed by robotic arms include: picking and placing, sorting, welding, screwing, machine tending, painting, and injection molding. In general, robotic arms are viewed as "industrial robots" and carry out repetitive as well as dangerous processes; they complete certain tasks faster and more efficiently than humans do and are designed to perform with higher accuracy."
Source: Frost & Sullivan

Opportunities of Robotics in Enterprise Industry

"Robotics technology has been undergoing major technological growth in recent years. With the advent of Industry 4.0 and smart factories, all industries across the spectrum are adopting advanced robotic automation solutions for varied applications according to industry requirements.
Currently, the main robotic technologies are categorized under collaborative robots (cobots), robotic exoskeletons, warehouse and logistics robots.
Robotic technology is a convergence of other advanced technologies like artificial intelligence (AI), machine learning, LiDar and sensor fusion.
The Growth Opportunity report on Opportunities of Robotics in Enterprise Industry discusses about the impact of Collaborative Robots, Material Handling Robots and Robotic Exoskeletons in the Enterprise Industry."
Source: Frost & Sullivan

Growth Opportunities In 3d Printing, Robotic Solutions, And Wearable Exoskeletons

"The Advanced Manufacturing Technology Opportunity Engine for August 2021 covers innovations in additive manufacturing, robotics, and exoskeletons. Some of the key innovations profiled include magnetic field controlled robots, electrically actuated robotic grippers, material handling, delivery robots, a metal casting process based on 3D printing, and wearable exoskeletons.
The Advanced Manufacturing TOE covers global innovations and developments related to manufacturing and industrial automation on a monthly basis. Innovations are focused toward improving product traceability, energy efficiency and reducing environmental footprints, integrating product design and manufacturing aspects for reducing time-to-market. Research focus areas include rapid prototyping (additive manufacturing), lightweighting (multimaterial joining, plastics and

energy. Now, researchers reporting in ACS Central Science have developed a shape memory polymer that stores almost six times more energy than previous versions."
Source: EurekAlert!

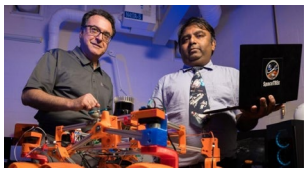
Soft components for the next generation of soft robotics

"The World Robotics report shows that Europe is the region with the highest robot density globally, with an average value of 114 units per 10,000 employees in the manufacturing industry. For more facts about robots watch IFR´s video news about Europe in one minute."
Source: Harvard

Walking with coffee is a little-understood feat of physics

"Walking with coffee is something most of us do every day without considering the balancing act it requires. In fact, there's a lot of physics preventing the coffee from spilling over.
The coffee, a thermally agitated fluid contained in a cup, has internal degrees of freedom that interact with the cup which, in turn, interacts with the human carrier."
Source: Arizona State University

SWARM ROBOTICS



Researchers Enlist Robot Swarms to Mine Lunar Resources

"The World Robotics report shows that Europe is the region with the highest robot density globally, with an average value of 114 units per 10,000 employees in the manufacturing industry. For more facts about robots watch IFR´s video news about Europe in one minute."
Source: University of Arizona

STOCKBOT

Decathlon to implement PAL Robotics' StockBot in facilities worldwide

"Sports goods giant Decathlon and PAL Robotics have launched a global partnership after PAL Robotics' StockBot inventory tracking and data collection solution was selected for rollout across Decathlon stores in

parking method to improve the handling ability of vehicles under extreme conditions. The whole process is divided into two parts: the location approach part and the drift part. The model predictive control (MPC) method was used in the approach to achieve consistency between the actual state and the expected state. For drift, the open-loop control law was designed on the basis of drift trajectories obtained by professional drivers. The drift monitoring strategy aims to monitor the whole drift process and improve the success rate of the drift. A simulation and an actual vehicle test platform were built, and the test results show that the proposed algorithm can be used to achieve accurate vehicle drift to the parking position."
Source: MDPI

Heterogeneity of autonomous vehicle adoption behavior due to peer effects and prior-AV knowledge

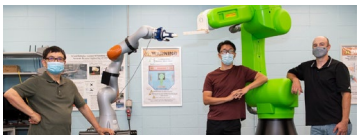
"The current paper explores how AV adoption is influenced by various factors, especially by different levels of individual susceptibility and prior-AV knowledge. Susceptibility is a latent variable measuring to what extent individuals will follow the influence of their peers in AV adoption. Prior-AV knowledge is another latent variable that measures people's knowledge about AVs, which will further impact their price sensitivity. A stated preference (SP) survey was carried out in five cities in China. 1132 new car buyers were surveyed, resulting in 3855 valid records for vehicle preference. The Integrated Choice and Latent Variable (ICLV) Model is used to measure the susceptibility and prior-AV knowledge attributes, and identify their contribution to the heterogeneity of AV adoption intentions. The results show that many demographic factors influence the adoption of AVs. Younger individuals, those with higher education levels, higher income, and more driving experience are more readily influenced by their peers. High market penetration has a significant influence on FAV adoption, but to a varying degree depending on the individual susceptibility level. People with prior-AV knowledge, who are more likely to be older drivers, have no children under 18, have higher incomes and higher education levels, are found to be less sensitive to vehicle price."
Source: Springer Link

SMART ROBOTS

metals manufacturing, carbon fiber-based composite manufacturing), smart robotics (agile robots, consumer robots, swarm robotics, cobots), monitoring and control (wireless control networks, human machine interface), and simulation and modeling (design and simulation software)."
Source: Frost & Sullivan

multiple countries, assisting the team and elevating in-store experience."
Source: Robotics & Automation

ARTIFICIAL INTELLIGENCE



These robots can move your couch

"In the Intelligent Robotics and Autonomous Systems Lab of UC aerospace engineering professor Ou Ma, student researchers developed artificial intelligence to train robots to work together to move a couch — or in this case a long rod that served as a stand-in — around two obstacles and through a narrow door in computer simulations.
"We made it a little more difficult on ourselves. We want to accomplish the task with as little communication as possible among the robots," student Barth said."
Source: UC CincInnati

Faster path planning for rubble-roving robots

"Robots that need to use their arms to make their way across treacherous terrain just got a speed upgrade with a new path planning approach, developed by University of Michigan researchers.
The improved algorithm path planning algorithm found successful paths three times as often as standard algorithms, while needing much less processing time.
A new algorithm speeds up path planning for robots that use arm-like appendages to maintain balance on treacherous terrain such as disaster areas or construction sites, U-M researchers have shown. The improved path planning algorithm found successful paths three times as often as standard algorithms, while needing much less processing time."
Source: University of Michigan

Simple Linking of Units Gives Legged Robots New Way to Navigate Difficult Terrain

"Working with Daniel Goldman, Dunn Family professor in the School of Physics at Georgia Tech, Yasemin Ozkan-Aydin, a former postdoc in Goldman's lab and now an assistant professor at the University of Notre Dame, developed "quadruped" robots using easily acquired off-the-shelf technology. Each unit has a 3D-printed, two-segmented chassis and body, four flexible legs, a "passive tail" appendage for additional balance and directional control, touch and light sensors, and a central-body-mounted microprocessor. A

Introduction to the focused section on flexible mechatronics for robotics

"Flexible mechatronics have been playing a critical role for intelligent robots in unstructured environments and extreme conditions that needs efficient task performance, adaptability to handle nonlinear behaviors and robustness to unpredictable disturbances. To achieve these goals, robotic systems with compliant mechanical structures and flexible electronic components must be properly designed, where challenges in precise modeling, efficient analysis, smart sensing and actuation, and effective control schemes have attracted broad attention from researchers.

With the emerging applications to robotics, this focused section competitively selects the 10 research papers covering a spectrum of theoretical backgrounds and applications including industrial automation, infrastructure monitoring, wearable technologies, bio-inspired and biomimetic robots. Although boundaries among the papers can depend on multi-metrics, they are categorized from the perspectives to promote flexible mechatronics for intelligent robotics and applications spanning theoretical modeling, system identification and feature recognition, novel control methods for flexible systems, and smart sensing/actuation in promising applications of human-centered and autonomous robots."
Source: Springer Link

COLLABORATIVE ROBOTS

Using neuro-accelerators on FPGAs in collaborative robotics tasks

"All collaborative robotic device cannot function without the necessary information about the surrounding location of the objects with which it must interact. The sources of such information are various sensors transmitting data to the central computer, which processes the incoming signals and decides on further actions. Today, the main problem of creating collaborative robots is the operational

magnetic connector allows for docking and cooperative behaviors. The research team recently published its work in Science Robotics.

Reconfigurable swarm robots have been used in prior research into terrain solutions. But these units have limited motive abilities, require human intervention, and lack the desired ease of scale-up for manufacturing and use in a timely and cost-effective manner."

Source: Georgia Tech

ROBOTS FOR HEALTHCARE

Scientists Develop Improved Algorithm for Upper Arm Rehabilitation Robots

"Robot-assisted exercise therapy is effective for stroke rehabilitation. But the design of rehabilitation robots is complicated by a peculiar problem related to "inverse kinematics," where the angles of the robot's joints have to be back-calculated from their desired final positions; often, the calculated angles are unnatural for the human body. Now, scientists from Japan have developed a faster, less resource-intensive method to provide naturally feasible solutions to inverse kinematics in upper arm rehabilitation robots."

Source: Shibaura Institute of Techonology

Tiny 'maniac' robots could deliver drugs directly to central nervous system

"iseases in the central nervous system can be difficult to treat. "Delivering drugs orally or intravenously, for example, to target cancers or neurologic diseases, may affect regions of the body and nervous system that are unrelated to the disease," explained Lamar Mair of Weinberg Medical Physics, a medical device company based in the US and an industrial partner on the study. "Targeted drug delivery may lead to improved efficacy and reduced side-effects due to lower off-target dosing."

Source: EurekAlert!

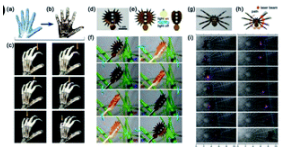
BIOMIMICRY

Small, mighty robots mimic the powerful punch of mantis shrimp

processing and interpretation of data from various types of sensors, including stereo cameras. Increasing the processing speed of the input data stream to identify potentially dangerous situations is the main requirement for the joint safe operation of a robot and a person in a dynamically changing environment. This work is devoted to a comparative analysis of neural network architectures for the purpose of using in sensor systems of collaborative robots."

Source: SPIE

SOFT ROBOTICS



Recent progress of biomimetic motions—from microscopic micro/nanomotors to macroscopic actuators and soft robotics

"Motion is a basic behavioral attribute of organisms, and it is a behavioral response of organisms to the external environment and internal state changes. Materials with switchable mechanical properties are widespread in living organisms and play crucial roles in the motion of organisms. Therefore, significant efforts have been made toward mimicking such architectures and motion behaviors by making full use of the properties of stimulus-responsive materials to design smart materials/machines with specific functions. In recent years, the biomimetic motions based on micro/nanomotors, actuators and soft robots constructed from smart response materials have been developed gradually. However, a comprehensive discussion on various categories of biomimetic motions in this field is still missing. This review aims to provide such a panoramic overview. From nano-to macroscales, we summarize various biomimetic motions based on micro/nanomotors, actuators and soft robotics."

Source: Royal Society of Chemistry

Bioinspired High-Degrees of Freedom Soft Robotic Glove for Restoring Versatile and Comfortable Manipulation

"The human hand is one of the most complex and compact grippers that has arisen as a product of natural genetic engineering; it is highly versatile, as it handles power and precision tasks. Since proper contact points and force directions are required to ensure versatility and secure a stable grip on an object,

"Modeling the mechanics of the strongest punch in the animal kingdom, researchers with U.S. Army funding built a robot that mimics the movement of the mantis shrimp. These pugnacious crustaceans could pave the way for small, but mighty robotic devices for the military.
Researchers at Harvard University and Duke University, published their work in Proceedings of the National Academy of Sciences. They shed light on the biology of mantis shrimp, whose club-like appendages accelerate faster than a bullet out of a gun. Just one strike can knock the arm off a crab or break through a snail shell. These crustaceans have even taken on an octopus and won."
Source: Harvard University and Duke University

Leaping squirrels could help scientists develop more agile robots

"With funding from the U.S. Army, researchers at University of California, Berkeley studied how squirrels decide whether or not to take a leap and how they assess their biomechanical abilities to know whether they can land safely.
Understanding how squirrels learn the limits of their agility could help scientists design autonomous robots that can nimbly move through varied landscapes to help with military missions such as traveling through the rubble of a collapsed building to aid in search and rescue or to quickly access an environmental threat."
Source: US Army

HUMAN-ROBOT INTERACTIONS

When humans play in competition with a humanoid robot, they delay their decisions when the robot looks at them

"Gaze is an extremely powerful and important signal during human-human communication and interaction, conveying intentions and informing about other's decisions. What happens when a robot and a human interact looking at each other? Researchers at IIT-Istituto Italiano di Tecnologia (Italian Institute of Technology) investigated whether a humanoid robot's gaze influences the way people reason in a social decision-making context. What they found is that a mutual gaze with a robot affects human neural activity, influencing decision-making there must be a large workspace and controllable tip force directions for the digits. Although they are important, many individuals with neuromuscular diseases experience loss of these features. Thus, we propose a high-degree-of-freedom (DOF) soft robotic glove inspired by the anatomical features of human hands. The mechanism for adjusting the position and force direction of each tip is based on the structure of the extrinsic and intrinsic muscle–tendon units. The large thumb workspace was achieved by assisting opposition/reposition and flexion/extension to enable various grasping postures. A bidirectional actuation control mechanism with a cable-actuated agonist and an elastomer antagonist increased the assisted DOF and maintained compactness. The kinematic and kinetic performances of our device were evaluated by performing tests with eight stroke survivors. The thumb workspace increased by 43%, 207%, and 248% in the distal–proximal, dorsal–palmar, and radial–ulnar directions, respectively."
Source: Marie Ann Liebert

Soft robotic constrictor for in vitro modeling of dynamic tissue compression

"Here we present a microengineered soft-robotic in vitro platform developed by integrating a pneumatically regulated novel elastomeric actuator with primary culture of human cells. This system is capable of generating dynamic bending motion akin to the constriction of tubular organs that can exert controlled compressive forces on cultured living cells. Using this platform, we demonstrate cyclic compression of primary human endothelial cells, fibroblasts, and smooth muscle cells to show physiological changes in their morphology due to applied forces. Moreover, we present mechanically actuatable organotypic models to examine the effects of compressive forces on three-dimensional multicellular constructs designed to emulate complex tissues such as solid tumors and vascular networks."
Source: Nature Scientific Reports

Insect-like robots learn to turn

"Small, soft robots could be useful in a variety of challenging environments, such as disaster areas, but their lack of rigid components means that they have poor agility, and there is often a trade-off between high lateral speed and having the good rotational control needed for making turns. Some insects, such as ants, achieve fast motion and turning simultaneously by varying the friction

processes, in particular delaying them. Thus, a robot gaze brings humans to perceive it as a social signal. These findings have strong implications for contexts where humanoids may find applications such as co-workers, clinical support or domestic assistants."
Source: EurekAlert!

SUSTAINABILITY

Package delivery robots' environmental impacts: Automation matters less than vehicle type

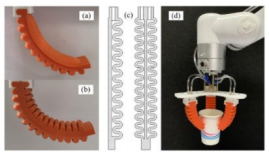
"Whether a robot or a person delivers your package, the carbon footprint would essentially be the same, according to a University of Michigan study that could help inform the future of automated delivery as the pandemic fuels a dramatic rise in online shopping.
The researchers examined the environmental impacts of advanced residential package delivery scenarios that use electric and gas-powered autonomous vehicles and two-legged robots to ferry goods from delivery hubs to neighborhoods, and then to front doors. They compared those impacts with the traditional approach of a human driver who hand-delivers parcels."
Source: EurekAlert!

The carbon footprint of 'delivering the goods' with robots and automated vehicles

"The researchers looked at 12 scenarios, ranging from a human-operated delivery process to a totally automated system, along a typical suburban route where one package is dropped off every half mile. In each scenario, they calculated the greenhouse gas emissions, or the carbon footprint, for each package delivered. To do this, they added up emissions data from production and lifetime operation for a commercial walking robot and different cargo vans, including human-driven and self-driving models, gasoline- and battery-powered models and two cargo sizes."
Source: EurekAlert!

between their feet and the ground. Liwei Lin, Min Zhang, Junwen Zhong and colleagues have now developed an ant-inspired soft robot that can combine high speed with trajectory control."
Source: Nature Electronics

ACTUATORS



Contact force estimation of hydraulic soft bending actuators for gripping

"Force measurement of soft actuators has drawn much research interest to realize closed-loop feedback. This work develops an estimation method of contact force of hydraulic soft bending actuators for gripping instead of installing force sensors at interaction position. A simplified analytical model is developed to reveal the relationships among the hydraulic pressure, the bending angle, and the contact force. The method includes the following three steps. Firstly, the bending angle varying with the hydraulic pressure is calibrated when the soft actuators are operated in free space. Secondly, the modulus of elasticity is identified by blocking the soft actuators at initial state. Thirdly, the output force of the soft actuators touching an object is estimated according to the model by measuring the bending angle and the hydraulic pressure through visual and pressure sensors."
Source: Taylor & Francis Online

Light-driven untethered soft actuators based on biomimetic microstructure arrays

"Soft actuators based on smart materials and structures that can perform more diverse tasks skillfully, are being intensively sought. Despite the good progress made in the past few years, locomotion and transportation functionalities of the untethered soft-bodied devices for various natural terrains remain challenging. Inspired by a gecko crawling system, an untethered soft actuator with the abilities of picking up, transporting, and delivering objects controlled by NIR light is proposed. The soft actuator consisting of photo-responsive MWCNTs units and mushroom shaped microstructures, was fabricated by an integrative soft-lithography method with inking and imprinting processes. The integrated MWCNTs unit can convert NIR light irradiation into thermal energy, which can make the

body of the soft actuator generate a strong shape deformation intrinsically in a self-contained way, leading to a combined discontinuous and continuous locomotion."
Source: Royal Society of Chemistry

ARTIFICIAL INTELLIGENCE

Artificial intelligence (AI) and robotics in travel, hospitality and leisure

"With the ongoing COVID-19 pandemic, it has become even clearer that tourism is highly dependent on technological solutions. The continuing crisis calls for institutional innovation to conceptualize resilient, agile, and flexible strategic initiatives and operations (Gretzel, 2021). Smart technologies, such as artificial intelligence (AI) and robotics, are creating an important driving force for travel, hospitality, and leisure (THL) during the pandemic and beyond, paving the way for new business models, new customer touchpoints, and new value (co-)creation opportunities. These technologies facilitate human experiences, support critical business processes, and enable important governance aspects."
Source: Springer Link

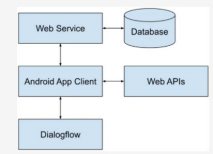
COGNITIVE ROBOTICS

The Development and Challenges of Robot Cognition

"Cognition is a fundamental and key issue of intelligent robots, which can provide robots with intelligence in terms of various human cognition behaviors. In order to achieve the human's high-level cognitive ability to complex environment and tasks, much effort has been made to the researches on neuroscience, cognitive science and related areas. Recently, biological research with information technology integration is an important trend of research. A series of computational neural models accounting for visual cognition process have been proposed. In particular, one of the remarkable results is the famous the hierarchical Max-Pooling (HMAX) model, which is a hierarchical feed-forward model of the ventral stream of the primate

visual cortex. Each level in the model is designed according to the results of biological experiments, which mimics the structure and function of the visual cortex and can enhance the analysis ability in multiple visual recognition tasks."
Source: Springer Link

SOCIAL ROBOTICS



Development and Usability Validation of a Social Robot Platform for Physical and Cognitive Stimulation in Elder Care Facilities

"This article shows our work for developing an elder care platform for social interaction and physical and cognitive stimulation using the Pepper robot and Android OS as clients, based on the knowledge acquired on our long-term social robotics research experience. The first results of the user's acceptance of the solution are presented in this article. The platform is able to provide different services to the user, such as information, news, games, exercises or music. The games, which have a bi-modal way of interacting (speech and a touch screen interface), have been designed for cognitive stimulation based on the items of the mini-mental state examination. The results of the user's performance are stored in a cloud database and can be reviewed by therapists through a web interface that also allows them to establish customized therapy plans for each user. The platform has been tested and validated, first using adult people and then deployed to an elder care facility where the robot has been interacting with users for a long period of time. The results and feedback received have shown that the robot can help to keep the users physically and mentally active as well as establish an emotional link between the user and the robot."
Source: MDPI

HUMAN ROBOT INTERACTION

Intention Recognition in Human Robot Interaction Based on Eye Tracking

"In human robot interaction any input that might help the robot to understand the human behaviour is valuable, and the eyes and their movement undoubtedly hold valuable information. In this paper we propose a novel algorithm for intention recognition using eye tracking in human robot collaboration. We first explore how the Cascade Effect hypothesis and a LSTM-based machine learning model perform to classify intent from gaze. Second, an algorithm is proposed, which can be used in a real time interaction to infer intention from the human user with a small uncertainty. A data collection with 30 participants was conducted in virtual reality to train and test the algorithm. The algorithm allows to detect the user intention up to two seconds before any user action with a success rate of up to 75%. These results open the possibility to study human robot interaction, where the robot can take the initiative based on the intention recognition."
Source: Springer Link

ROBOTICS IN HEALTHCARE

Early Experience of a Robotic Foregut Surgery Program at a Cancer Center: Video of Shared Steps in Robotic Pancreatoduodenectomy and Gastrectomy

"Over the past few decades, robotic surgery techniques required to resect gastric and pancreatic malignancies have evolved remarkably; however, the safety and generalizability of robotic pancreatoduodenectomy remain unknown. At our cancer center, gastrectomies and pancreatectomies are performed in a combined foregut minimally-invasive surgery program; this effectively increases the composite case volume and shortens the learning curve for any individual surgeon. In this video, we demonstrate the shared steps in pancreatoduodenectomy and gastrectomy and explain how the skills gained through robotic gastrectomy can be used during robotic pancreatoduodenectomy. During the initial 2-year period of our robotic foregut surgery program, we performed 120 pancreatic and gastric operations, including 22 pancreatoduodenectomies and 37 gastrectomies. Our first robotic pancreatoduodenectomy was performed following successful

completion of 45 other robotic foregut operations. Of those 22 patients who underwent robotic pancreatoduodenectomy, the median hospital stay was 4 days (range 3–17 days) and the readmission rate was 14% (3/22). The rate of grade B/C pancreatic fistula was 9% (2/22) and there was no 90-day mortality. In conclusion, the presented video showing the shared steps in robotic pancreatoduodenectomy and gastrectomy demonstrates the potential for a combined robotic surgery program to increase composite case volumes and to shorten the learning curve."
Source: Springer Link

Combined endoscopic robotic surgery for complex colonic polyp resection: case series

"Background
The study objective was to evaluate combined endoscopic and robotic surgery, a novel surgical technique modifying traditional combined endoscopic laparoscopic surgery through robotic assistance, and characterize a series of patients who underwent the modified operative technique.
Methods
A retrospective case series was performed. The first thirty-seven consecutive patients who underwent combined endoscopic robotic surgery by a single colorectal surgeon from March 2018 to October 2019 were included. Main outcome measures included operative time, intra-operative complication, 30-day post-operative complication, and hospital length of stay."
Source: Springer Link

Does robotic vs freehand screw placement affect patient reported outcomes in 1-3 level lumbar fusion?

"BACKGROUND CONTEXT
Studies have shown robotically-assisted surgery demonstrates increased pedicle screw accuracy when compared to conventional freehand surgery. However, little research has been done to determine if this increased accuracy translates to improved clinical outcomes.
PURPOSE
The purpose of this study is to compare patient reported outcome measures (PROMs) for patients undergoing one to three level lumbar fusion using robotically-assisted vs freehand screw placement."
Source: The Spine Journal